Petr Stepanov

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Summary of Qualifications

Work Experience

Research Collaborator (On-Site)

Thomas Jefferson National Laboratory (JLab), Newport News, VA. **Jul 2020 - Jan 2023**

- Coded a Geant4-based sumulation for studying the optimal light guide length (range 0-10 cm) for the EM calorimeter used in the Electron-Ion-Collider (EIC) project. Link to GitHub.
- Used Machine Learning (ML) techniques to perform binary classification of thousands of signals from a data acquisition (DAQ) setup. Link to GitHub.
- Applied CERN ROOT framework (C++) to perform statistical analysis of a significant amount (over 100 GB) of the raw experimental data of the Kaon LT experiment at JLab. Link to GitHub.
- Utilized SLURM functionality on the High-Performance Computing (HPC) environment to execute series of the simulations in parallel. This reduced the wall time by more than 10 times.
- Proposed and implemented RAMDisk functionality on the development environment. This led to an over 50% increase in source code indexing time.
- Set up data acquisition system that performs triggered waveform acquisition involving 3 devices - Tektronix oscilloscope, Network Attached Storage, and RedHat computer (SAMBA, Python, National Instruments NI-VISA library).
- Contributed 100+ shifts at the Hall C in Thomas Jefferson Particle Accelerator facility for the Pion LT project.

Postdoctoral Researcher (Remote)

Catholic University of America (CUA), Washington, DC. **Jul 2020 - Jan 2023**

- Programmed a Geant-4 computer simulation (C++, CMake, Eclipse IDE, gdb) to study performance of a novel scintillation material for EIC, Brookhaven National Lab. Link to GitHub.
- Visualized energy deposition profiles and calculated energy resolutions for variety of detector assemblies.
- Teaching experience. Mentoring students within a 3-month Research Experiences for Undergraduates (REU) program at the Physics Department at CUA. Giving talks and presentations about Linux Terminal, and supercomputer environment.
- Enhanced debugging of the core library source code led to the publishing of more than 10 bug reports on the ROOT (C++) forum.

Research Assistant

Bowling Green State University (BGSU), Bowling Green, OH. **Aug 2014 - May 2020**

- Assembled positron lifetime and Doppler spectrometers from ORTEC and Canberra (Mirion) fast electronic units. Utilized High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems for single-photon counting.
- Developed three open-source programs (C++, CERN ROOT) for a novel interpretation of the positron lifetime and Doppler experimental spectra.
  - Derived and solved kinetic equations describing the formation and chemical reactions of e+ and Ps atoms in solids, liquids, and nano-powders (Wolfram Mathematica).
  - Incorporated physical parameters (grain size, defect concentrations, rate constants) into custom models (PDFs with convolution) for fitting of the experimental spectra (RooFit).
- Above research allowed for estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations) and characterization of the chemical decoration of defects.
- Wrote three desktop GUI programs for spectra fitting and interpretation (C++, CMake, ROOT, Qt, Java)
  - GitHub repositories contain over 10k lines of code in total: TLIST Processor, SW Calculator, RooPositron.
  - Extended default ROOT GUI library (Qt-based) to support the MVP design pattern.
- Wrote a GUI application LuminApp (Java, Swing) to parse and merge time-stamped data from optical spectrometer and thermometer. This increased data processing time by two orders of magnitude.
- Developed static website (Hexo, Gulp, Bootstrap) and visual identity for the SelimLab research group. The website has a 99% Google performance rank and features 700 ms time to interactive metrics.

- Maintained local Apache HTTP server physics.bgsu.edu hosting over 10 websites at the BGSU.
- Created website for the ICPA-18 international conference with registration (over 150 users) and payment system workflow (WordPress, PHP, Recurly.js), and landing pages for events.

Frontend Developer, UI/UX Designer • Freelance **Sep 2012 - May 2020**

- Designed and built an online e-commerce store Sticker Store LLC with a static website generator (Figma, Hexo, Snipcart, Bootstrap, SASS, Express.JS, EJS, Node.js).
  - Improved the Google PageSpeed Insights metrics (CLS, LCP) up to 97%.
  - Created a recursive script to export over 300 products from YAML file to Google Merchant.
  - Optimized SEO. The project reached over 1400 organic monthly users.
- Made iOS application (Swift, UIkit, storyboards) for the We.Team messenger (more than 3k monthly downloads in AppStore). Participated in cloud-based messenger development with enhanced file sharing capabilities (HTML, React JS, SASS).
- Migrated the landing page for Sweetbridge company from WordPress to Jekyll static site generator (Ruby, CSS). This resulted in a 70% improvement in the page load time.
- Developed the front-end part (Angular.js, HTML, LESS) for Lili Social network.
  - Assisted with iOS mobile application (Ionic).
  - Enabled SEO crawling of over 1000 Angular.js pages with Google bot.
- Web design.
  - Designed logos, UI/UX prototypes (Figma, Sketch, Illustrator) and branding identity for over 10 different companies.
  - Converted numerous design assets and mockups into responsive HTML and CSS.
  - Mocked up and integrated dozens of cross-browser responsive email templates.

Full Stack Web Developer, Web Designer

Gridnine Systems, Moscow, Russia. **Apr 2011 - Aug 2014**

- Prototyped and designed interactive mockups for Otixo cloud file integrator (Balsamiq, Adobe Creative Suite). Utilized Google Web Toolkit (GWT) Model-View-Presenter (MVP) framework to develop application frontend (JavaScript, responsive CSS).
- Responsible for the front-end development of the ATH American Express – the largest travel management company in Russia (JavaScript, Backbone.js, and RequireJS). Increased the front-end load time by over 30%.
- Implemented image processing servlets on the backend to generate banners for five different social networks (PHP, ImageMagic).
- Wireframed and sliced to web pages numerous UI/UX mockups for web applications (Balsamiq, Photoshop, HTML and CSS).

Computer Science Teacher

Phys-Tech College at MIPT, Moscow, Russia. **Oct 2009 - May 2011**

- Provided instructions and guidance to high school students on following computer courses: C/C++ programming, HTML, Adobe Photoshop and 3D Studio Max.

Research Scientist

Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia. **Sep 2008 - Apr 2011**

- Application of positron lifetime spectroscopy for studying the radioactive-induced defects in steels. Monte-Carlo particle simulations with Fortran 95. Maintaining software for CAMECA tomographic atom probe (MSVC). Application of CERN ROOT libraries for fitting and analysis of experimental spectra.

Material Research Skills

- **Characterization facilities**. Positron Lifetime and Doppler Broadening Annihilation Spectroscopy (PALS, DBAR). Atom Probe Tomography (ATP). Scanning Electron Microscopy (SEM). Transmission electron microscopy (TEM). Atomic Force Microscopy (AFM). UV-VIS Spectroscopy. Fourier Transform Infrared Spectroscopy (FTIR).
- **Material processing**. High-temperature annealing. Wet chemical etching. Electrical Contact Fabrication. Sample polishing.

Education

Bowling Green State University (BGSU) • OH, USA **Aug 2014 - May 2020**

Ph.D. in Photochemical Sciences • GPA 3.423. Novel developments in positron annihilation spectroscopy techniques—from experimental setups to advanced processing software. View manuscript.

- Assembled and utilized two spectrometers: positron lifetime and Doppler. Spectrometers are built from ORTEC and Canberra (Mirion) fast electronic units and utilize High-Purity Germanium Detectors (HPGe) and scintillation-based detector systems.
- Developed open-source software (C++, CERN ROOT) for a novel interpretation of the experimental spectra.
- Defined and resolved kinetic equations of reactions of positron and positronium atoms (Ps) in solids and liquids and nano-powders (Wolfram Mathematica). Equation parameters are implemented in the fitting model of experimental spectra (RooFit).
- Above research allowed for the estimation of defect concentrations and sizes in solids, classification of defect types (vacancies, dislocations), and more...

Ohio Supercomputer Workshop • OH, USA **Jan 2017 - Feb 2017**

Hands-on sessions in Supercomputer Essentials. Introduction to the key developments in the supercomputer field.

- RedHat and CentOS operating systems: environment, networking, and SSH.
- Supercomputer job control with BASH and SLURM scripts.
- CMake compiling platform, use of parallel nodes, A.I. fundamentals and more..."

British Higher School of Art and Design (BHSAD) • Moscow, Russia **Dec 2011 - Feb 2012**

Three-month intensive course in Graphical Design and Visual Communications. Lectures and hands-on experience in graphic design and user interfaces.

- Intensive covered following subjects: brand identity, illustration principles, typography and lettering, effective advertising campaigns.

National Research Nuclear University (MEPhI) • Moscow, Russia **Sept 2004 - Feb 2011**

B.S. and M.S. in Solid State Physics. Defect studies of neutron-irradiated nuclear power plant vessel steels by means of positron annihilation spectroscopy.

Featured Publications

- P. S. Stepanov, F. A. Selim et al. Interaction of positronium with dissolved oxygen in liquids. *Physical Chemistry Chemical Physics* **2020**, 22 (9), 5123-5131. 10.1039/c9cp06105c.
- P. S. Stepanov, F. A. Selim et al. A model for joint processing of LT and CDB spectra of dielectric nano-sized powders. *AIP Conference Proceedings 2182* **2019**. 10.1063/1.5135836.
- P.S. Stepanov, S.V. Stepanov et al. Developing New Routine for Processing Two-Dimensional Coincidence Doppler Energy Spectra and Evaluation of Electron Subsystem Properties in Metals. *Acta Physica Polonica A* **2017**, 132 (5), 1628-1633. 10.12693/aphyspola.132.1628.

Conferences

18th International Conference on Positron Annihilation (ICPA-18) **Aug 2018**

Orlando, FL, USA

Oral talk "Positions and Ps in Al_2O_3 Nanopowders

International Workshop on Physics with Positrons (JPos17) **Sept 2017**

JLab, Newport News, VA, USA

Poster "A routine of background subtraction from two-dimensional Doppler broadened spectra"

12th International Workshop on Positron and Positronium Chemistry (PPC12) **Sept 2017**

Maria Curie-Sklodowska University, Lublin, Poland

Poster "Developing new routine for processing two-dimensional coincidence Doppler energy spectra"

Ohio Photochemical Society Meeting (Oops) **May 2017**

Maumee Bay Lodge & Conference Center, Maumee, OH, USA

Poster "Developing new routine for background subtraction in two-dimensional coincidence Doppler broadening spectroscopy"

58th Electronic Materials Conference (EMC) **Jun 2016**

University of Delaware, Newark, DE, USA

Oral talk "High-Sensitivity Measurements of Defects in ZnO by Means of Digital Coincidence Doppler Broadening of Positron Annihilation Spectroscopy"

Annual Spring Meeting of the APS Ohio-Region **Apr 2016**

University of Dayton, Dayton, OH, USA

Oral talk "Identification of chemical environment of defects in ZnO by means of digital coincidence Doppler broadening of positron annihilation radiation"

Ohio Inorganic Weekend **Nov 2015**

Bowling Green State University, OH, USA

Poster "Approaching Structural Defect Characterization and their Chemical Identification by Means of Coincidence Doppler Broadening of Annihilation Radiation"

41st Polish Seminar on Positron Annihilation (PSPA-13) **Sep 2013**

Maria Curie-Sklodowska University, Lublin, Poland

Oral talk "Application of positron spectroscopy for detection of nanostructures in alcohol—aqueous mixtures"

Professional Networks

- Find examples of my code on GitHub (50+ repositories).
- Discover my professional contacts on LinkedIn (200+ connections).
- Skim through the list of my publications on Google Scholar (24 articles, 300+ citations).
- Check out my UI design portfolio on Dribbble (50+ shots).

Interests

- Hosting an open-source project for keyboard remapping on Linux 300+ stars on GitHub.
- Contributing to the C++ open source framework ROOT. Created two shared libraries to facilitate data analysis. Links to GitHub: CanvasHelper and RootUtils.